

Application No.: 10/718,581

IN THE CLAIMS

Please amend the claims as follows:

1. (Currently amended) A semiconductor light emitting device comprising:

a semiconductor substrate;

a semiconductor layered structure provided on the semiconductor substrate and comprised of a lower cladding layer made of semiconductor of a first conductivity type, an active layer having a resonator in a direction parallel to the semiconductor substrate, and an upper cladding layer made of semiconductor of a second conductivity type;

an upper electrode connected to the upper cladding layer and extending in a stripe shape in a resonator direction; and

a lower electrode connected to the lower cladding layer, wherein

the semiconductor layered structure has a photonic crystal structure on a front surface thereof in which a plurality of concave portions or convex portions are arranged periodically in the resonator direction,

the photonic crystal structure is configured such that at least part of the photonic crystal structure does not overlap with the upper electrode and the photonic crystal structure and the upper electrode are arranged in the resonator direction as seen in a plan view, and

when a predetermined voltage is applied between the upper electrode and the lower electrode, light radiates from a hole supplied from the lower electrode through the lower cladding layer and an electron supplied from the upper electrode through the upper cladding layer are re-coupled to each other within the active layer to thereby generate light in a region of the photonic crystal structure which does not overlap with the upper electrode as seen in [[a]] the plan view and a region of the photonic crystal structure which overlaps with the upper electrode as seen in the plan view, and

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the light radiates from the region of the photonic crystal structure which does not overlap with the upper electrode as seen in the plan view in a direction perpendicular to the resonator direction.

2. (Original) The semiconductor light emitting device according to Claim 1, wherein the concave portions or the convex portions are formed in the upper cladding layer.

3. (Original) The semiconductor light emitting device according to Claim 1, wherein the concave portions or the convex portions are formed in the upper cladding layer, the active layer, and the lower cladding layer.

4. (Original) The semiconductor light emitting device according to Claim 1, wherein the concave portions or the convex portions are cylindrical.

5. (Original) The semiconductor light emitting device according to Claim 1, wherein the concave portions or the convex portions are flat-plate shaped.

6. (Original) The semiconductor light emitting device according to Claim 1, wherein the resonator has a width of not less than $2\mu\text{m}$ and not more than $10\mu\text{m}$.

7. (Original) The semiconductor light emitting device according to Claim 1, wherein the resonator has a length of not less than $20\mu\text{m}$ and not more than $50\mu\text{m}$.

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8. (Original) The semiconductor light emitting device according to Claim 1, wherein the resonator direction is $\langle 110 \rangle$ direction or $\langle -110 \rangle$ direction.

9. (Original) The semiconductor light emitting device according to Claim 1, wherein the concave portions or convex portions are arranged in the shape of rectangular lattice such that one arrangement direction of the concave portions or the convex portions corresponds with the resonator direction and another arrangement direction is perpendicular to the resonator direction.

10. (Original) The semiconductor light emitting device according to Claim 9, wherein a spacing between adjacent concave portions or convex portions in the one arrangement direction is different from a spacing between adjacent concave portions or convex portions in the another arrangement direction.

11. (Original) The semiconductor light emitting device according to Claim 10, wherein the spacing between adjacent concave portions or convex portions in the one arrangement direction is larger than the spacing between adjacent concave portions or convex portions in the another arrangement direction.

12. (Original) The semiconductor light emitting device according to Claim 1, wherein reflection films are provided on both end faces of the semiconductor layered structure.

13. (Original) The semiconductor light emitting device according to Claim 1, wherein the semiconductor layered structure is provided with a photonic crystal structure on a periphery

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thereof, and the photonic crystal structure is comprised of a plurality of concave portions or convex portions arranged at a predetermined spacing.

14. (Original) The semiconductor light emitting device according to Claim 1, wherein the concave portions or the convex portions are provided over an entire upper surface of the semiconductor layered structure.

15. (Original) The semiconductor light emitting device according to Claim 14, wherein the region of the photonic crystal structure that does not overlap with the upper electrode as seen in a plan view is located at a center portion of the semiconductor layered structure.

16. (Original) The semiconductor light emitting device according to Claim 1, wherein a spacing between part of the concave portions or convex portions adjacent in the resonator direction is larger than a spacing between another concave portions or convex portions by a wavelength/ (actual refractive index \times 4).

17. (Original) The semiconductor light emitting device according to Claim 1, comprising a plurality of semiconductor layered structures, wherein the plurality of semiconductor layered structures are arranged to cross one another.

18. (Currently amended) A method of fabricating a semiconductor light emitting device comprising:

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a semiconductor substrate; a semiconductor layered structure provided on the semiconductor substrate and comprised of a lower cladding layer made of semiconductor of a first conductivity type, an active layer having a resonator in a direction parallel to the semiconductor substrate, and an upper cladding layer made of semiconductor of a second conductivity type; an upper electrode connected to the upper cladding layer and extending in a stripe shape in a resonator direction; and a lower electrode connected to the lower cladding layer, the semiconductor layered structure having a photonic crystal structure on a front surface thereof in which a plurality of concave portions or convex portions are arranged periodically in the resonator direction, the photonic crystal structure being configured such that at least part of the photonic crystal structure does not overlap with the upper electrode and the photonic crystal structure and the upper electrode are arranged in the resonator direction as seen in a plan view, wherein when a predetermined voltage is applied between the upper electrode and the lower electrode, a hole supplied from the lower electrode through the lower cladding layer and an electron supplied from the upper electrode through the upper cladding layer are re-coupled to each other within the active layer to thereby generate light in a region of the photonic crystal structure which does not overlap with the upper electrode as seen in the plan view and a region of the photonic crystal structure which overlaps with the upper electrode as seen in the plan view, and the light radiates from the region of the photonic crystal structure which does not overlap with the upper electrode as seen in the plan view in a direction perpendicular to the resonator direction, wherein light radiates in a direction substantially perpendicular to the semiconductor substrate;

the method comprising the steps of:

epitaxially growing the semiconductor layered structure on the semiconductor substrate;

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etching the semiconductor layered structure to form [[a]] the photonic crystal structure comprised of [[a]] the plurality of concave portions arranged periodically in [[a]] the resonator direction; and

forming the upper electrode on the upper cladding layer so as to extend in stripe shape in the resonator direction such that the upper electrode does not overlap with at least part of the photonic crystal structure and the upper electrode and the photonic crystal structure are arranged in the resonator direction as seen in [[a]] the plan view.

19. (Currently amended) A method of fabricating a semiconductor light emitting device comprising:

a semiconductor substrate; a semiconductor layered structure provided on the semiconductor substrate and comprised of a lower cladding layer made of semiconductor of a first conductivity type, an active layer having a resonator in a direction parallel to the semiconductor substrate, and an upper cladding layer made of semiconductor of a second conductivity type; an upper electrode connected to the upper cladding layer and extending in a stripe shape in a resonator direction; and a lower electrode connected to the lower cladding layer, the semiconductor layered structure having a photonic crystal structure on a front surface thereof in which a plurality of concave portions or convex portions are arranged periodically in the resonator direction, the photonic crystal structure being configured such that at least part of the photonic crystal structure does not overlap with the upper electrode and the photonic crystal structure and the upper electrode are arranged in the resonator direction as seen in a plan view, wherein when a predetermined voltage is applied between the upper electrode and the lower electrode, a hole supplied from the lower electrode through the lower cladding layer and an

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electron supplied from the upper electrode through the upper cladding layer are re-coupled to each other within the active layer to thereby generate light in a region of the photonic crystal structure which does not overlap with the upper electrode as seen in the plan view and a region of the photonic crystal structure which overlaps with the upper electrode as seen in the plan view, and the light radiates from the region of the photonic crystal structure which does not overlap with the upper electrode as seen in the plan view in a direction perpendicular to the resonator direction, wherein light radiates in a direction substantially perpendicular to the semiconductor substrate,

the method comprising the steps of:

epitaxially growing the semiconductor layered structure on the semiconductor substrate;

selectively growing crystal on the upper cladding layer of the semiconductor layered structure to form [[a]] the photonic crystal structure comprised of [[a]] the plurality of concave portions arranged periodically in the resonator direction; and

forming the upper electrode on the upper cladding layer so as to extend in stripe shape in the resonator direction such that the upper electrode does not overlap with at least part of the photonic crystal structure and the upper electrode and the photonic crystal structure are arranged in the resonator direction as seen in [[a]] the plan view.

20. (New) The semiconductor light emitting device according to claim 1, wherein a high energy end or a low energy end of a photonic band gap of the photonic crystal structure conforms to an energy of the light generated by re-coupling within the active layer.

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21. (New) The semiconductor light emitting device according to claim 20, wherein the high energy end of the photonic band gap of the photonic crystal structure conforms to the energy of the light generated by re-coupling within the active layer.

22. (New) The semiconductor light emitting device according to claim 20, wherein the low energy end of the photonic band gap of the photonic crystal structure conforms to the energy of the light generated by re-coupling within the active layer.

23. (New) The semiconductor light emitting device according to claim 20, wherein the light generated by re-coupling within the active layer is coupled to the photonic band gap, thereby causing the light to super-radiate in the direction perpendicular to the resonator direction.